

CLAIMS

What is claimed is:

1. A multilayer dielectric film comprising:

a first layer formed of a metal oxide material having a dielectric constant κ and

5 thickness t ; and

a second layer formed on said first layer, said second layer is formed of a metal silicate material having a dielectric constant lower than the dielectric constant of said first layer and a thickness smaller than the thickness of said first layer.

2. The multilayer dielectric film of claim 1 wherein said first layer is comprised of

10 a material having a dielectric constant in a range of 15 to 200.

3. The multilayer dielectric film of claim 1 wherein said second layer is comprised of a material having a dielectric constant in a range of 5 to 100.

4. The multilayer dielectric film of claim 1 wherein said first layer is a metal oxide having the formula of M_xO_y , where M is a metal selected from the group consisting of Zr, Hf, Ti, V, Nb, Ta, Cr, Mo, W, Mn, Zn, Al, Ga, In, Ge, Sr, Pb, Sb, Bi, Sc, Y, La, Be, Mg, Ca, Sr, Ba, Th, Lanthanides (Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu), and mixtures thereof, x is a number in the range of 1 to 3, and y is a number in the range of 2 to 5.

5. The multi layer dielectric film of claim 4 wherein said metal oxide includes more than one metal element.

20 6. The multilayer dielectric film of claim 4 wherein said first layer is a metal oxide selected from the group consisting of ZrO_2 and HfO_2 .

7. The multilayer dielectric film of claim 1 wherein said second layer is a metal silicate having the formula of M_xSiO_y , where M is a metal selected from the group consisting of Zr, Hf, Ti, V, Nb, Ta, Cr, Mo, W, Mn, Zn, Al, Ga, In, Ge, Sr, Pb, Sb, Bi, Sc, Y, La, Be, Mg, Ca, Sr, Ba, Th, Lanthanides (Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu), and mixtures thereof, x is a number in the range of 1 to 3, and y is a number in the range of 2 to 5.

8. The multi layer dielectric film of claim 7 wherein said metal silicate includes more than one metal element.

9. The multilayer dielectric film of claim 7 wherein said second layer is a metal silicate selected from the group consisting of Zr-Si-O and Hf-Si-O.

5 10. The multilayer dielectric film of claim 1 wherein said first layer has a thickness in a range of about 30 to 80 Å.

11. The multilayer dielectric film of claim 1 wherein said second layer has a thickness of one to two atomic layers.

12. A multilayer dielectric film comprising:

10 a first layer formed of a metal oxide material having a dielectric constant κ and a thickness t in the range of about 30 to 80 Å; and

a second layer formed on said first layer, said second layer is formed of a metal silicate material having a dielectric constant lower than the dielectric constant of said first layer and a thickness in the range of one to two atomic layers.